CMPT215 Quiz 1

10/10

Consider two different implementations, M1 and M2, of the same instruction set. There are 3 different classes of instructions in the ISA. M1 has a clock rate of 800 MHz and M2 has a clock rate of 500 MHz. CPI and instruction mix is as follows.

Class	M1 CPI	M2 CPI	C1 Usage (%) (M1)	C2 Usage (%) (M2)
A	4	1	30	70
B	6	4	50	20
C	8	6	20	10

C1 is a compiler produced by the manufacturers of M1, C2 is a compiler produced by the manufacturers of M2.

Assume that each compiler uses the same number of instructions for a given program but that the instruction mix is as described in the table above.

1) Using C1 on both machines, compare the performance of the two machines. Which machine is faster, and by how much?
2) Using C2 on both machines, compare the performance of the two machines. Which machine is faster, and by how much?
3) If you could mix and match compilers and machines, what configuration would you choose? Assume that costs are identical.

I = # instructions

1) $ET_{M1} = \frac{I(0.3) + I(6)(0.5) + I(8)(0.2)}{800(10^6)}$

$\frac{I(1.2) + I(3.0) + I(1.6)}{800(10^6)} = \frac{I\,5.8}{800(10^6)}$ secs

(4) $ET_{M2} = \frac{I\,0.3 + I(4)(0.5) + I(6)(0.2)}{500(10^6)} = \frac{0.3I + 2.0I + 1.2I}{500(10^6)} = \frac{3.5I}{500(10^6)}$ secs

$Perf(\frac{M2}{M1}) \frac{\frac{3.5I}{500(10^6)}}{\frac{5.8I}{800(10^6)}} = \frac{3.5I}{500(10^6)} \cdot \frac{800(10^6)}{5.8I} = \frac{3.5(8)}{5(5.8)} = \frac{28}{29}$

Should be M1/M2 so I flipped → 29/28

* M2 is 29/28 times faster than M1 using C1.*

2) $ET_{M1} = \frac{0.7(4) + 0.2(6) + 0.1(8)}{800(10^6)} = \frac{2.8 + 1.2 + 0.8}{800(10^6)} = \frac{4.8}{800(10^6)}$ sec

(4) $ET_{M2} = \frac{0.7(1) + 0.2(4) + 0.1(6)}{500(10^6)} = \frac{0.7 + 0.8 + 0.6}{500(10^6)} = \frac{2.1}{500(10^6)}$ sec

$Perf \frac{M1}{M2} \left(\frac{1.2}{2}\right)\left(\frac{500(10^6)}{2.1}\right) = \frac{6.0}{4.2}$

* M2 is $\frac{6.0}{4.2}$ times faster than M1 using C2.*

over